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ABSTRACT

A study investigated free recall of information bounded by internally inconsistent sentences compared to the same information in consistent text versions. Data were elicited from 40 undergraduate students enrolled in classes in educational psychology. Subjects were instructed to read one consistent and one inconsistent (containing two propositions separated by three intervening sentences) text passage presented on a computer and were then asked to free recall as much of the passages as they could remember. Results revealed no main effect for passage order but a significant effect on version. Recall of target propositions was significantly greater when the information was in the consistent version than when the same information was in the inconsistent version. The advantage of consistent version over inconsistent version held for both passages. The findings indicated that decreased recall is effected by cognitive activity that occurs after initial processing; this is consistent with the reduced recall prediction of the "cognitive dumping" hypothesis. (One table of data is included.) (KEH)

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Recall of Information Separating Two Inconsistent Propositions: An Experimental Test of the "Cognitive Dumping" Hypothesis

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Abstract

Research on cognitive capacity usage in reading has shown that allocation of capacity is influenced by text, task, and process variables. However, contrary to initial intuition, a greater reserve of cognitive capacity appears to be available for other activities (eg. performance of a secondary task) while reading more difficult text, or coping with text confusions, than when reading normal, easy text. This has been interpreted as a result of periodic emptying of the short-term memory (sic. working memory) and processing registers during more demanding tasks, while the registers are more consistently full during easier processing tasks. A prediction from this "cognitive emptying" hypothesis is that recall of information "emptied" should be reduced. This research investigated free recall of information bounded by internally inconsistent sentences conpared to the same information in consistent text versions. Results indicate significantly reduced recall of target propositions in the inconsistent versions. Results are interpreted as consistent with the "cognitive dumping" hypothesis.

Introduction

A great deal of recent research has been done in the area of comprehension monitoring during text processing. The overwhelming conclusion of that research is that, compared to less competent readers, competent readers display greater use of both comprehension-fostering and comprehension-monitoring processes, greater flexibility in adjusting processes to task demands, and better performance on tests of comprehension of what they have read. In addition, there is evidence that competent and less competent readers vary in the amount of cognitive capacity they invest in the tasks of comprehension and comprehension monitoring, and that the capacity demands of reading are sensitive to task (Britton, et al., 1979a), text (Britton, et al., 1978, 1979b; Clark & Forlizzi, 1989) and individual difference variables (Barksdale & Niles, 1989; Clark & Forlizzi, 1989).

While studies of the use of comprehension monitoring strategies, and effect of such use on comprehension, remain a hot area of research, the mechanisms underlying monitoring processes remain somewhat unclear. Comprehension monitoring involves both awareness of the on-going success of one's comprehension processes (detection), and the selection and initiation of remedial strategies (repair) designed to cope with comprehension failure (Baker & Brown, 1984). One central mechanism involved in the detection of internal problems in text appears to be a process of coherence testing during comprehension. Models of text

comprehension proposed by Kintsch (Kintsch, 1979; Kintsch & van Dijk, 1978) posit a testing process involving selection of a subset of text propositions for retention in a limited-capacity monitoring buffer, and comparison of new propositions to those in the buffer in search of propositional overlap. Several factors, including propositional importance and recency of presentation in the text, have been identified which influence the selection of propositions for retention in the working memory buffer; these propositions, then, serve as the basis for initial coherence tests. Prior research exploring the effect of amount of intervening text on detection of inconsistencies by college students found no decrement in performance with up to 4 sentences intervening between inconsistent propositions, but marked decrements in performence with 8 intervening sentences (Clark, 1988). Similar disrupting effects of intervening information have been reported on both text inferencing and semantic integration tasks. These results suggest a functional buffer size somewhere between six and ten propositions.

Additional research indicates that detection of errors in text is associated with a temporary decrease in investment of cognitive capacity in the reading task (Clark & Forlizzi, 1989). This decrease in particular, and similar decreases in allocation of cognitive capacity due to text difficulty (Britton, et al., 1978), or reading anxiety (Barksdale & Niles, 1989) have been interpreted as resulting from periodic elimination of non-essential information from the working memory buffer, thereby freeing up additional capacity for coping with other demands. This periodic elimination of information has been referred to as "cognitive

dumping" (Clark & Forlizzi, 1989; see also Britton, et al., 1978, for a similar notion). One consequence of such a dumping process might be the elimination of propositions currently in working memory but not relevant to a detected inconsistency. If such propositions are eliminated from working memory prior to integration with the existing (or emerging) schema for the text material, then later recall of the information in those propositions would be expected to be reduced. The purpose of the present research is to test such a prediction of the cognitive dumping hypothesis. Specifically it would be hypothesized that recall of text material intervening between two inconsistent propositions would be reduced compared to recall of similar text with no inconsistency.

Method

Subjects. Subjects were 40 undergraduate students enrolled in classes in educational psychology. All subjects were native speakers of English with no obvious reading deficits. All subjects were volunteers who received credit applicable to their course grades for participation.

Materials. The experimental materials consisted of two text passages adapted from prior research (Clark, 1989; Clark & Forlizzi, 1989). Each passage was approximately 600 words in length, and dealt with topics relevant to educational psychology but not currently in the students' course of study. Two versions of each passage were constructed, one (inconsistent version) containing two inconsistent propositions separated by three intervening sentences, and the second (consistent version)

containing no inconsistency. Each of the three intervening sentences contained two propositions. Information in the two versions of each passage was identical with the exception of a critical sentence that was either consistent or inconsistent with prior information. Previous research with subjects similar to those in the present study indicated that a high percentage of subjects detect the text inconsistencies (Clark & Forlizzi, 1989). The two passages also differed in their rated difficulty (see Forlizzi & Clark, 1989 for details), with the passage on Mental Imagery rated significantly more difficult than the passage on Field Dependence.

Procedures. Subjects were seen in small groups of 3-6 persons in a single experimental session. Each subject was seated individually at an Apple IIE microcomputer. Subjects were instructed that they were to read two text passages presented on the computer, and that following each passage they would be asked to write a complete summary of what they had read. Passages were presented one sentence at a time on microcomputer with subjects controlling exposure time and passage sentence sequence by pressing predesignated keys on the keyboard to move forward or backward in the text.

Each subject read both passages, one in consistent version and the other in inconsistent version. Order of presentation of the passage versions was counterbalanced across subjects. Following each passage, subjects were asked a series of probes patterned after Forlizzi (1989) and Clark & Forlizzi (1988) to assess awareness of the inconsistency. Following the probes, subjects were asked to free recall as much of the

passage as they could remember. Recalls were written long hand on loose leaf paper.

Results

Recall protocols were scored for total propositional recall, and for recall of target propositions in the three sentences bounded by the inconsistency. For the purposes of the present discussion, only recall of target propositions will be discussed. Since each of the target sentences contained two propositions, maximum target recall was six for each passage and version. Means and standard deviations (SD's) for recall by Passage and Consistent/Inconsistent Version are presented in Table 1.

Recall of target propositions was analyzed using a 2 (Passage Order) X 2 (Version - Consistent/Inconsistent) mixed factor ANOVA. In the analysis, Passage Order was a between subjects factor, while Version was a within subjects factor. Results indicate no main effect for Passage Order ($F(1, 38 \text{ d.f.}) = .016$, n.s.). There was, however, a significant effect for Version ($F(1, 38 \text{ d.f.}) = 43.626$, $p < .001$. Recall of target propositions was significantly greater when the information was in the consistent version (mean=2.425) than when the same information was in the inconsistent version (mean=1.00). The advantage on consistent version over inconsistent version held for both passages.

There was also a significant Passage Order X Consistent/Inconsistent Version interaction ($F(1, 38 \text{ d.f.}) = 5.992$, $P = .02$). Given the nature of the data entry, this interaction reflects an effect for passage. Subjects

recalled more target propositions from the passage on Field Dependence and Field Independence (mean=1.975) than from the passage on Mental Imagery (mean=1.45). The passage advantage held for both consistent and inconsistent versions. This finding of a passage effect is consistent with initial passage difficulty estimates, and indicates that subjects recalled more from the easier passage.

Discussion

Prior research has suggested that readers have more available, or "free", cognitive capacity while reading more difficult text, coping with text errors, or coping with anxiety about reading. These results have been interpreted as reflecting a cycle of periodically emptying the processing registers during times of processing demand, while maintaining a cycle of more constant usage during times of easier processing demand (Britton, et al., 1978; Clark & Forlizzi, 1989). This explanation has been termed "cognitive dumping" (Clark & Forlizzi, 1989). Prior research (Clark, & Forlizzi, 1989) suggests that a "cognitive dumping" cycle can be induced by inserting detectable internal inconsistencies into text.

One prediction of the "cognitive dumping" hypothesis is that readers will maintain fewer propositional clusters over time in a working memory buffer to serve as a basis for developing a schema for information in the text. Additionally, propositions that are "dumped" from working memory during the register emptying cycle would receive less extended processing, would be less likely to be integrated into a schema for

passage content, and would be less likely to be recalled.

In the present investigation, subjects recalled significantly fewer target propositions when they were presented in an inconsistent version of a text passage than when the same propositions were presented in a consistent version of the passage. Since the target propositions occurred in the text prior to the inconsistent line, decreased recall must have been effected by cognitive activity that occurred after initial processing. These results are consistent with the reduced recall prediction of the "cognitive dumping" hypothesis.

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Table 1

Recall of Target Propositions

	Field Dependence		Mental Imagery	
Consistent	2.70	1.22	2.15	.75
Inconsistent	1.25	.97	.75	.64

Max=6